Amendment to the Claims:

The claims under examination in this application, including their current status and changes made in this paper, are respectfully presented.

Claims 1 through 17 are canceled.

18 (previously presented). A method for transmitting a frame synchronization pattern utilizing a plurality of frequency tones, said method comprising:

obtaining a frame synchronization pattern;

grouping the pattern into pairs of binary values;

assigning a first pair of binary values to at least one subcarrier;

associating a second pair of binary values with a pilot tone and overwriting the second pair of binary values with values corresponding to a constant complex amplitude for the pilot tone;

mapping each of a plurality of remaining pairs of binary values to a complex amplitude;

assigning each of the mapped pairs to a corresponding one of the frequency tones;

suppressing the amplitude of at least one of the frequency tones;

then modulating at least a subset of the frequency tones in accordance with the mapped pairs corresponding thereto to produce modulated frame synchronization data; and

transmitting the modulated frame synchronization data.

19 (previously presented). A method as recited in claim 18, wherein the at least one subcarrier includes the d.c. and Nyquist subcarriers.

20 (previously presented). A method as recited in claim 18, wherein the modulated frame synchronization data is a multicarrier symbol.

21 (previously presented). A method as recited in claim 18, wherein the frame synchronization pattern is determined by the following equations:

$$x[p] = 1 \text{ for } p = 1 \text{ to } 9,$$

$$x[p] = x[p-4] \oplus x[p-9] \text{ for } p = 10 \text{ to } 512,$$

where $x[p]$ represents a binary value of the p^{th} value of the sequence, and $\oplus$ represents modulo-2 addition.

22 (previously presented). A method as recited in claim 21, wherein the modulated frame synchronization data comprises a sequence of time-domain samples;

and further comprising:

prior to the transmitting step, adding a cyclic prefix corresponding to a selected number of samples from the end of the sequence of time-domain samples.

23 (previously presented). A method as recited in claim 18, further comprising:

allocating a bit loading for the plurality of frequency tones;

and wherein the suppressing step suppresses the amplitude of at least one of the plurality of frequency tones having a bit loading below a selected level.

24 (previously presented). The method of claim 23, wherein the selected level is two bits.

25 (previously presented). The method of claim 23, wherein the allocating of a bit loading for each frequency tone is based on a signal-to-noise ratio for the frequency tone.

26 (previously presented). The method of claim 23, further comprising:

producing an energy scaling vector for the plurality of frequency tones from the bit loading;

wherein the suppressing step comprises:

for at least one of the plurality of frequency tones, multiplying the complex amplitude of the mapped pair of binary values by the energy scaling vector for that tone.

27 (previously presented). The method of claim 23, further comprising a step of initializing communications with a receiver, prior to the allocating step, the initializing step comprising:

obtaining the frame synchronization pattern;

grouping the pattern into pairs of binary values;

mapping each pair of the binary values to a complex amplitude;

assigning each of the mapped pairs to a corresponding one of the frequency tones of the multicarrier modulation transmission system;

modulating at least a subset of the frequency tones in accordance with the mapped pairs corresponding thereto to produce modulated frame synchronization data; and

transmitting the modulated frame synchronization data to a receiver, so that the receiver can achieve frame synchronization with the transmitter.

28 (previously presented). A method as recited in claim 18, further comprising:

after the modulating and suppressing steps, converting the modulated frame synchronization data from digital data to analog signals at a selected sampling frequency;

wherein the sampling frequency is an integral power of two times the frequency of the pilot tone.

29 (previously presented). A method as recited in claim 18, wherein the transmitting step periodically transmits the modulated frame synchronization data among modulated data frames.

30 (previously presented). A method as recited in claim 18, wherein the transmitting step transmits the modulated frame synchronization data over two-wire telephone subscriber line.

31 (previously presented). A method as recited in claim 18, wherein the transmitting step transmits the modulated frame synchronization data in an asynchronous digital subscriber line system in an upstream direction of transmission.

32 (previously presented). A method as recited in claim 18, wherein the transmitting step transmits the modulated frame synchronization data in an asynchronous digital subscriber line system in a downstream direction of transmission.

33 (previously presented). A transmitter for communicating data using multicarrier modulation, said transmitter comprising:

a frame synchronization sequence source for producing a sequence of binary values, wherein a first pair of the binary values is associated with d.c. and Nyquist subcarrier frequencies, and wherein each of a plurality of the remaining pairs of the binary values defines a complex amplitude for an associated frequency tone in a frequency domain synchronizing frame multicarrier symbol;

circuitry for suppressing the complex amplitude of at least one of the frequency tones in the frequency domain synchronizing frame multicarrier symbol from that defined by its associated pair of binary values;

a modulator, for producing a time domain multicarrier symbol from the frequency domain synchronizing frame multicarrier symbol; and

a digital-to-analog converter for converting the time domain multicarrier symbol to an analog output signal.

34 (previously presented). The transmitter of claim 33, wherein the suppressing circuitry comprises:

a bit allocation table, for providing an energy scaling vector by which the complex amplitude for at least one of the frequency tones in the frequency domain synchronizing frame multicarrier symbol is multiplied prior to being applied to the modulator.

35 (previously presented). The transmitter of claim 33, wherein the suppressing circuitry suppresses the complex amplitude of at least one of the frequency tones in the frequency domain synchronizing frame multicarrier symbol having a bit loading below a selected level.

36 (previously presented). The transmitter of claim 33, further comprising:

a coder for encoding a data stream into frequency domain multicarrier data symbols arranged in frames;

wherein the modulator also produces time domain multicarrier data symbols from the frequency domain multicarrier data symbols;

and wherein the digital-to-analog converter also converts the time domain multicarrier data symbols to an analog signal.

37 (previously presented). The transmitter of claim 36, wherein the modulator periodically modulates the frequency domain synchronizing frame multicarrier symbol frequency domain multicarrier data symbols.

38 (previously presented). The transmitter of claim 33, wherein the frame synchronization sequence source comprises circuitry for storing the frame synchronization pattern.

39 (previously presented). The transmitter of claim 33, wherein the modulator comprises an inverse FFT unit.

40 (previously presented). The transmitter of claim 33, wherein the sequence of binary values is determined by the following equations:

$$x[p] = 1 \text{ for } p = 1 \text{ to } 9,$$

$$x[p] = x[p-4] \oplus x[p-9] \text{ for } p = 10 \text{ to } 512,$$

where $x[p]$ represents a binary value of the pth value of the sequence, and $\oplus$ represents modulo-2 addition.

41 (previously presented). The transmitter of claim 33, wherein the time domain multicarrier symbol comprises a sequence of time-domain samples;

and further comprising:

a cyclic prefix adder for adding a cyclic prefix corresponding to a selected number of samples from the end of the sequence of time-domain samples.

42 (previously presented). The transmitter of claim 41, wherein the selected level is two bits.

43 (previously presented). The transmitter of claim 33, wherein the digital-to-analog converter operates at a sampling frequency that is an integral power of two times the frequency of the pilot tone.

44 (previously presented). The transmitter of claim 33, further comprising:

an analog-to-digital converter for converting a received analog signal to a serial time domain sample stream;

a demodulator for demodulating the time domain sample stream to a frequency domain multicarrier symbol; and

circuitry for recovering a decoded signal from the frequency domain multicarrier symbol.

45 (previously presented). The transmitter of claim 44, further comprising:

a hybrid circuit, for coupling an input of the analog-to-digital converter and an output of the digital-to-analog converter to a transmission path.

46 (previously presented). The transmitter of claim 45, wherein the transmission path comprises two-wire telephone subscriber line.

47 (previously presented). The transmitter of claim 45, wherein the digital-to-analog converter operates at a first sampling frequency so that the output analog signal corresponds to a first rate of transmission;

and wherein the received analog signal corresponds to a second rate of transmission.

48 (previously presented). The transmitter of claim 47, wherein the first rate of transmission is higher than the second rate of transmission.

49 (previously presented). The transmitter of claim 47, wherein the first rate of transmission is lower than the second rate of transmission.

50 (previously presented). The transmitter of claim 33, wherein a second pair of the binary values is associated with a pilot frequency tone and is overwritten with a constant complex amplitude for the pilot frequency tone.

51 (previously presented). A method for transmitting a frame synchronization pattern utilizing a plurality of frequency tones, said method comprising:

obtaining a frame synchronization pattern;

grouping the pattern into pairs of binary values;

assigning a first pair of binary values to d.c. and Nyquist subcarriers;

mapping each of a plurality of remaining pairs of binary values to a complex amplitude;

assigning each of the mapped pairs to a corresponding one of the frequency tones;

suppressing the amplitude of at least one of the frequency tones;

then modulating at least a subset of the frequency tones in accordance with the mapped pairs corresponding thereto to produce modulated frame synchronization data; and

transmitting the modulated frame synchronization data.

52 (previously presented). A method as recited in claim 51, wherein the frame synchronization pattern is determined by the following equations:

$$x[p] = 1 \text{ for } p = 1 \text{ to } 9,$$

$$x[p] = x[p-4] \oplus x[p-9] \text{ for } p = 10 \text{ to } 512,$$

where $x[p]$ represents a binary value of the p^{th} value of the sequence, and $\oplus$ represents modulo-2 addition.

53 (previously presented). A method as recited in claim 51, wherein the modulated frame synchronization data comprises a sequence of time-domain samples;

and further comprising:

prior to the transmitting step, adding a cyclic prefix corresponding to a selected number of samples from the end of the sequence of time-domain samples.

54 (previously presented). A method as recited in claim 51, further comprising:

allocating a bit loading for the plurality of frequency tones;

and wherein the suppressing step suppresses the amplitude of at least one of the plurality of frequency tones having a bit loading below a selected level.

55 (previously presented). The method of claim 54, wherein the selected level is two bits.

56 (previously presented). The method of claim 54, wherein the allocating of a bit loading for each frequency tone is based on a signal-to-noise ratio for the frequency tone.

57 (previously presented). The method of claim 54, further comprising:

producing an energy scaling vector for the plurality of frequency tones from the bit loading;

wherein the suppressing step comprises:

for at least one of the plurality of frequency tones, multiplying the complex amplitude of the mapped pair of binary values by the energy scaling vector for that tone.

58 (previously presented). A method as recited in claim 51, wherein the transmitting step periodically transmits the modulated frame synchronization data among modulated data frames.

59 (previously presented). A method as recited in claim 51, wherein the transmitting step transmits the modulated frame synchronization data over two-wire telephone subscriber line.

60 (previously presented). A method as recited in claim 51, wherein the transmitting step transmits the modulated frame synchronization data in an asynchronous digital subscriber line system in an upstream direction of transmission.

61 (previously presented). A method as recited in claim 51, wherein the transmitting step transmits the modulated frame synchronization data in an asynchronous digital subscriber line system in a downstream direction of transmission.

62 (previously presented). A method as recited in claim 51, further comprising:

associating a second pair of binary values with a pilot tone and overwriting the second pair of binary values with values corresponding to a constant complex amplitude for the pilot tone.

63 (new). A method of attaining frame synchronization in a multicarrier modulation transmission system in which a synchronizing frame containing at least a synchronizing pattern is transmitted in a multicarrier modulated signal, said method comprising:

receiving values of the synchronizing frame, the received values corresponding to complex amplitudes associated with respective ones of a plurality of tones of the multicarrier modulated signal;

applying weighting coefficients to one or more of the complex amplitudes;

correlating the weighted complex amplitudes with corresponding stored values of the synchronizing pattern to produce a comparison result; and

comparing the comparison result with at least one threshold value to provide an indication of existence or loss of frame synchronization,

wherein the synchronizing pattern corresponds to a set of j values chosen from a sequence of N values, the N values are determined by the following equations:

$$x[p] = 1 \text{ for } p = 1 \text{ to } 9,$$

$$x[p] = x[p-4] \oplus x[p-9] \text{ for } p = 10 \text{ to } N,$$

where j and N are integers greater than 1, j is less than or equal to N, and N is greater than 10, and where x[p] represents a binary value of the p^{th} value of the pseudo-random sequence, and $\oplus$ represents modulo-2 addition.

64 (new). The method of claim 63, further comprising::

determining an adjustment amount to restore frame synchronization when the result of the comparing step indicates that the frame synchronization has been lost; and

adjusting a frame boundary in accordance with the adjustment amount to restore frame synchronization.

65 (new). The method of claim 63, wherein the weighting coefficient applied to each of the one or more complex amplitudes corresponds to whether its associated tone is to contribute to the comparison result.

66 (new). The method of claim 65, wherein the weighting coefficient applied to complex amplitudes associated to a tone that is not to contribute to the comparison result is zero.

67 (new). The method of claim 65, wherein the weighting coefficient applied to complex amplitudes associated to a tone that is to contribute to the comparison result is one.

68 (new). The method of claim 63, wherein the weighting coefficient applied to complex amplitudes corresponds to a signal-to-noise ratio of its associated tone.